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MACROLEPIDOPTERAN LARVAE SAMPLED BY TREE BANDS IN TEMPERATE MESIC AND XERIC FORESTS IN EASTERN UNITED STATES

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Abstract.—We studied macrolepidopteran larval richness and abundance under canvas tree bands in 18 oak-dominated plots in the George Washington National Forest in Virginia and the Monongahela National Forest in West Virginia. In each plot, 12 canvas-banded trees were monitored from early May through mid-August in 1995 and 1996, totalling 216 trees. The bands trapped a total of 6,347 larvae representing 77 species in 8 macrolepidopteran families. Seventy-five percent of all larvae (4,773) were *Lymantria dispar* (L.) (Lymantriidae). Of the remaining 1,574 larvae, 62% (981) were noctuids; 22% (348) arctiids, and 8% (129) lasiocampids. The most abundant species after *Lymantria dispar,* were *Morrisonia latex* (Guenée) (Noctuidae) (5%), *Hypoprepia fucosa* Hübner (Arctiidae) (4%), *Phoberia atomaris* Hübner (Noctuidae) (2%), and *Abagrotis alternata* (Grote) (Noctuidae) (2%). Differences in species distribution and abundance occurred between forests and between years.

Key Words: Macrolepidopteran larvae, canvas tree bands, forest caterpillars, gypsy moth, diversity

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Relatively few studies have been conducted on communities of forest macrolepidopteran larvae in North America. These studies include Lepidoptera associated with an outbreak species (Stevens et al. 1984), seasonal diversity and abundance on specific host species (Marquis and Passoa 1989; Butler 1992; Wagner et al. 1995), and larval species and abundance in areas being treated with insecticides for gypsy moth suppression (Miller 1990; Butler and Kondo 1993; Butler et al. 1995a, b; Wagner et al. 1995, 1996).

In most of these studies, macrolepidopteran larvae were sampled only from foliage. However, studies by Butler and Kondo (1993), Butler et al. (1995a), Butler et al. (1997), and Wagner et al. (1995, 1996) sampled them from under burlap or canvas bands, thus establishing tree banding as a viable method for assessing lepidopteran larval diversity or nontarget spray impact.

In 1994, we began a study of impact of the biological spray *Bacillus thuringiensis kurstaki* Berliner and defoliation by gypsy moth, *Lymantria dispar* L., on nontarget arthropods in large plots in two adjacent national forests in the central Appalachians. Pretreatment sampling of macrolepidopteran larvae from foliage and from canvas bands and adult macrolepidopterans by light trap was conducted in 1995 and 1996. Here we present the seasonal diversity of species in these forests as assessed by canvas tree bands. Other papers will cover results of the other sampling methods and a final paper will present species diversity indices and species accumulation curves for the lepidopteran community.

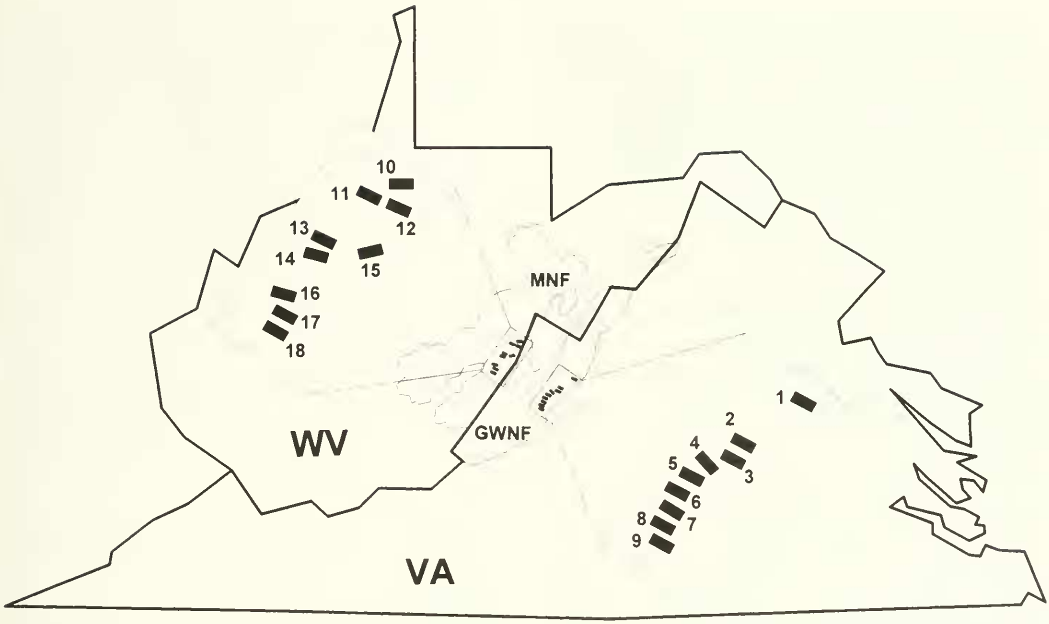

Fig. 1. Study area showing arrangements of plots 1–9 in the George Washington National Forest (GWNF) in Virginia (VA) and plots 10–18 in the Monongahela National Forest (MNF) in West Virginia (WV).

Materials and Methods

In 1994 18, 200-ha study plots were designated and flagged in gypsy moth susceptible oak-dominated forests. Plots 1 through 9 are located primarily on the eastern slope of Great North Mountain in the Deerfield Ranger District of the George Washington National Forest (GWNF), Augusta County, Virginia (Fig. 1). The GWNF plots are in a xeric forest of mixed oak and pine with a range in elevation of 586 through 791 m in the rain shadow of the Appalachians. Plots 10 through 18 are in the Monongahela National Forest (MNF), Pocahontas County, West Virginia (Fig. 1). Plots 10 through 12 are in the southern Greenbrier Ranger District on Chestnut Ridge (Paddy Knob North); plots 13 through 18 are in the Marlinton Ranger District, with plots 13 through 15 near Sugar Camp Run (Paddy Knob South) and plots 16 through 18 on Marlin Mountain. The MNF plots are in a more mesic forest with a range in elevation of 860 through 1,070 m.

In June 1995, rain gauges and maximum-minimum thermometers were installed in all 18 plots. Additional weather data was obtained from N.O.A.A. weather stations.

Thirty-cm wide, 18 oz. OD green canvas bands were stapled around the circumference of trees. The top edges of the bands were 1.4 m above the ground. Twelve dominant or codominant trees were banded in each of the 18 plots making a total of 216 trees. Generally in each plot, 6 banded trees were at a higher elevation near a ridge top and 6 were at a lower elevation within the watershed. Of the 12 trees in each plot, 10 were various oak species (*Quercus* spp.), one a red maple (*Acer rubrum* (L.) and one a hickory (*Carya* spp.). Among the 180 banded oak trees, 69 were in the red oak group (*Quercus coccinea* Muenchh, *Q. rubra* L., and *Q. velutina* Lambert), 57 were chestnut oak (*Q. prinus* L.), and 54 were white oak (*Q. alba* L.).

Caterpillars were removed from under bands weekly from early May through mid-August (9 May through 15 August; 7 May through 13 August, for 1995 and 1996, respectively). Larvae were placed in labelled, plastic 8-dram vials with snap lids and stored in a cooler in the field until they were returned to the laboratory in Morgantown, WV the following day. In the laboratory, vials were stored in a refrigerator at 4° C until larvae were identified the following day.

Voucher specimens from the study are deposited in the WVU Arthropod Collection. Species are listed in Table 1 according to the checklist given by Hodges et al. (1983), with modifications from Poole and Gentili (1996).

Results and Discussion

During the sampling seasons of 1995 and 1996, a total of 77 species of macrolepidopteran larvae were collected from canvas bands, 59 species from the GWNF and 52 species from the MNF (Table 1). These larvae represented 8 families, with most species being Noctuidae (40), followed by Geometridae (16), Arctiidae (9), and Lymantriidae (4). The remaining 4 families were represented by one to three species. Lymantriid larvae were the most abundant, with 4,792 individuals; 4,773 being gypsy moth, *Lymantria dispar*. Noctuid total abundance was 981 followed by Arctiidae (348), Lasiocampidae (129), Geometridae (52), and Saturniidae (36) (Table 1).

The more abundant species following the gypsy moth were *Morrisonia latex* (Guenée) (315), *Hypoprepia fucosa* Hübner (270), *Phoberia atomaris* Hübner (135), *Abagrotis alternata* (Grote) (117), *Malacosoma americana* (F.) (107), *Catocala amica* (Hübner) (79), *Orthosia rubescens* (Walker) (71), *Catocala ilia* (Cramer) (55), *Acronicta modica* (Walker) (51), *Epiglaea decliva* (Grote) (41), *Hemileuca maia* (Drury) (35), *Malacosoma disstria* Hübner (21), and *Lambdina fervidaria* (Hübner) (20) (Table 1). All of these most abundant species were taken from both forests with the exception of *H. maia* which was collected only from the GWNF. This species is collected more typically in dry oak-pine forests such as the GWNF than in more mesic mixed oak forests such as the MNF (Ferguson 1971; Butler et al. 1995b). Of other more abundant species, several were collected at a much higher percentage in the GWNF: *Morrisonia latex* (79%), *Phoberia atomaris* (82%), *Catocala amica* (72%), *Orthosia rubescens* (79%), and *Epiglaea decliva* (98%). *Malacosoma americana* was in similar abundance in both forests. The preferred host of *M. americana* in our study area is black cherry (*Prunus serotina* Ehrh.); the larvae do not feed on any of our banded tree species. In the last instar the larvae tend to wander in search of a pupation site (Franclemont 1973).

Several species were collected exclusively from a single forest. Listed in the order in which they appear in Table 1, these include: *Besma quercivoraria* (Guenée), *Nadata gibbosa* (J.E. Smith), *Zanclognatha lituralis* (Hübner), *Acronicta lobeliae* (Guenée), *Acronicta haesitata* (Grote), and *Himella intractata* (Morrison) from the MNF, and *P. titea* (Cramer), *Phigalia denticulata* Hulst, *P. strigataria* (Minot), *Erannis tiliaria* (Harris), *Campaea perlata* (Guenée), *Dryocampa rubicunda* (F.), *Meganola spodia* Franclemont, *Lithophane querquera* Grote, *L. antennata* (Walker), *Psaphida resumens* Walker and *Achatia distincta* Hübner from the GWNF. However, we collected only one individual of each of these species (Table 1).

An overall decline in larval abundance occurred from 1995 (5,129 larvae) to 1996 (1,218 larvae). *Lymantria dispar* had the greatest influence on that decline as its numbers under bands fell from 4,114 in 1995 to 659 in 1996. Exclusive of gypsy moth, larval numbers were 1,015 and 559 for 1995 and 1996, respectively (Table 1).

Among the 7 more abundant larval species (exclusive of gypsy moth), 5 declined from 1995 to 1996. *Hypoprepia fucosa* fell from 189 to 81; *Catocala ilia*, 43 to 12; *Catocala amica*, 69 to 10; *Orthosia rubescens*, 57 to 14; and *Abagrotis alternata*, 83 to 34. During that period, numbers of *Phob-*

eria atomaris larvae remained stable (60 in 1995 and 75 in 1996), while numbers of *Morrisonia latex* increased from 94 in 1995 to 221 in 1996.

We suggest that the decline in abundance of gypsy moth larvae from 1995 to 1996 was due to movement into the study areas of the gypsy moth fungus, *Entomophaga maimaiga* Humber, Shimazu, and Soper. Declines of other species may have been influenced by weather, changes in numbers of their natural enemies, or both. The plots were drier and warmer in 1995 than in 1996 (Table 2). Numerous studies have shown direct and indirect effects of weather trends and atypical catastrophic temperature and rain events on insect populations (Martinat 1987). The increase in abundance of *Morrisonia latex* may likely represent a cyclical buildup because numbers of this species have continued to climb in subsequent years of this study (unpublished data).

Tree bands mimic naturally occurring bark flaps and provide a refuge for caterpillars that move up and down trunks (Butler et al. 1995a). Thus, larvae under bands may be feeding on forest floor plants, lichens, or other organic matter on tree trunks (Wagner et al. 1995), or band collections may represent actual hosts. The highest number of larval species was collected from the red oak group (50), followed by white oak (39), chestnut oak (38), and hickory and maple (23 each). We note that tree species groups were not sampled equally; of the 216 total banded trees, 32% were red oak; 26%, chestnut oak; 25%, white oak; and maple and hickory, 8% each. The highest larval abundance was taken from red oak (2,438), followed by chestnut oak (2,250), white oak (885), hickory (484), and maple (290). Eighty-eight percent of the gypsy moth larvae were taken from *Quercus* spp., its preferred host; *Quercus* spp. were 83% of the banded trees. Among the banded oaks, 44% of the larvae were on red oak; 41%, on chestnut oak; and 15%, on white oak. Other species for which oaks are a preferred host include *Phoberia atomaris, Catocala amica,* and *C. ilia* (Forbes 1954). *Morrisonia latex* is considered to be a general feeder (Wood and Butler 1989), and it was collected from all host species in the current study; 85% were collected from the oak species. A similar pattern was seen for *Abagrotis alternata,* a general feeder on many tree species (Butler et al. 1997, Forbes 1954); it frequently feeds on blueberry (*Vaccinium* spp.) and other low woody plants, and climbs trees to shelter under bark flaps. *Hypoprepia fucosa* feeds on algae, lichens, and other organic material on tree trunks (Forbes 1960). While we might expect to find it randomly distributed among the tree species in our study, 87% of the larvae were on trunks of oaks; 74% of the larvae on oaks were on red and chestnut oaks, the species with the roughest bark that harbors notable quantities of lichens in our study plots. Those species groups represented 70% of the banded oaks.

During our 2 years of sampling, various species of larvae were taken from canvas bands throughout the season, from the earliest date (8 May) through the latest (14 August) (Table 1). Among the more abundant species were the spring defoliators such as *Malacosoma* spp., *Lymantria dispar, Phoberia atomaris, Catocala* spp., *Epiglaea decliva, Orthosia rubescens,* and *Abagrotis alternata,* that generally were collected from one of the earliest sample dates into June or July. The abundant lichen feeder *Hypoprepia fucosa* was sampled from 8 May through 22 July. The most abundant larva taken from bands during the summer was *Morrisonia latex,* collected from 10 July through 12 August (Table 1).

While collection of 77 species of macrolepidopteran larvae produces some useful information on species richness in the plots, information on seasonal diversity and forest differences can be evaluated for only a few of these species. Fifty-three species were represented by 5 or fewer specimens (Table 1). Only species that are in relatively high numbers and more typically shelter under

Table 1. Species and abundance of macrolepidopteran larvae collected from canvas bands of five tree groups in the George Washington (G) and Monongahela National Forest (M) in eastern United States during 1995 and 1996.

Family Species	Maple		Hickory		Red Oak	
	G	M	G	M	G	M
Lycaenidae						
Satyrium falacer (Godart)	0	0	0	0	3	1
Geometridae						
Alsophila pometaria (Harris)	0	0	0	0	0	0
Iridopsis larvaria (Guenée)	0	0	0	0	0	1
Melanolophia canadaria (Guenée)	0	0	0	0	1	1
Hypagyrtis unipunctata (Haworth)	1	0	0	0	0	0
Phigalia titea (Cramer)	0	0	0	0	0	0
Phigalia denticulata Hulst	0	0	0	0	1	0
Phigalia strigataria (Minot)	0	0	0	0	1	0
Erannis tiliaria (Harris)	0	0	0	0	1	0
Lomographa vestaliata (Guenée)	0	0	0	0	0	8
Campaea perlata (Guenée)	0	0	0	0	0	0
Probole amicaria (Herrich-Schäffer)	0	0	0	0	1	0
Besma quercivoraria (Guenée)	0	0	0	0	0	0
Lambdina fiscellaria (Guenée)	0	0	0	0	0	0
Lambdina fervidaria (Hübner)	0	0	0	0	5	2
Hydrelia condensata (Walker)	0	0	0	0	0	1
Eupithecia herefordaria Cassino & Swett	0	0	0	0	0	0
Lasiocampidae						
Tolype velleda (Stoll)	0	0	0	0	0	0
Malacosoma disstria Hübner	0	0	0	5	2	9
Malacosoma americana (F.)	1	1	0	5	36	28
Saturniidae						
Dryocampa rubicunda (F.)	1	0	0	0	0	0
Hemileuca maia (Drury)	0	0	1	0	6	0
Notodontidae						
Nadata gibbosa (J.E. Smith)	0	0	0	0	0	0
Heterocampa guttivitta (Walker)	0	0	0	0	0	0
Arctiidae						
Crambidia pallida Packard	0	0	0	0	1	0
Hypoprepia miniata (Kirby)	3	1	7	1	8	10
Hypoprepia fucosa Hübner	6	13	8	9	39	41
Clemensia albata Packard	0	0	0	0	1	1
Holomelina opella (Grote)	0	0	0	0	2	0
Holomelina nigricans (Reakirt)	0	0	0	0	3	0
Hyphantria cunea (Drury)	0	0	0	0	0	0
Ecpantheria scribonia (Stoll)	0	0	0	0	1	0
Halysidota tessellaris (J.E. Smith)	0	0	1	0	0	0
Lymantriidae						
Dasychira dorsipennata	0	1	0	0	1	4
(Barnes & McDunnough)	0	0	0	0	0	0
Dasychira basiflava (Packard)	0	0	1	0	1	0
Dasychira obliquata (Grote & Robinson)	0	0	1	0	0	1
Lymantria dispar (L.)	134	80	279	72	1,185	679
Noctuidae						
Idia aemula Hübner	2	1	1	0	0	2
Idia lubricalis (Geyer)	0	0	0	0	1	0

Table 1. Extended.

Chestnut Oak		White Oak		G		M		Years Combined		Grand Total	Seasonal Range
G	M	G	M	1995	1996	1995	1996	G	M		
0	2	0	0	3	0	3	0	3	3	6	22 May–12 June
0	0	1	1	1	0	1	0	1	1	2	29 May–12 June
0	0	0	0	0	0	0	1	0	1	1	1 July–1 July
1	3	0	1	2	0	4	1	2	5	7	29 May–3 June
0	0	0	1	1	0	0	1	1	1	2	15 May–24 June
1	0	0	0	1	0	0	0	1	0	1	22 May–22 May
0	0	0	0	1	0	0	0	1	0	1	22 May–22 May
0	0	0	0	1	0	0	0	1	0	1	22 May–22 May
0	0	0	0	1	0	0	0	1	0	1	29 May–29 May
0	0	0	1	0	0	9	0	0	9	9	7 Aug.–14 Aug.
1	0	0	0	1	0	0	0	1	0	1	17 July–17 July
0	0	0	0	0	1	0	0	1	0	1	5 Aug.–5 Aug.
0	0	0	1	0	0	1	0	0	1	1	7 Aug.–7 Aug.
2	0	0	0	2	0	0	0	2	0	2	19 June–31 July
4	1	2	6	4	7	3	6	11	9	20	19 June–12 Aug.
0	0	0	0	0	0	0	1	0	1	1	29 July–29 July
0	0	0	1	0	0	0	1	0	1	1	15 July–15 July
1	0	0	0	1	0	0	0	1	0	1	17 July–17 July
1	2	1	1	3	1	17	0	4	17	21	29 May–10 June
0	16	12	8	49	0	58	0	49	58	107	15 May–19 June
0	0	0	0	1	0	0	0	1	0	1	7 Aug.–7 Aug.
20	0	8	0	30	5	0	0	35	0	35	29 May–29 July
0	0	0	1	0	0	1	0	0	1	1	7 Aug.–7 Aug.
2	0	0	0	2	0	0	0	2	0	2	7 Aug.–7 Aug.
1	0	1	0	2	1	0	0	3	0	3	3 July–5 Aug.
10	5	5	7	21	12	23	1	33	24	57	22 May–17 June
62	31	23	38	84	54	105	27	138	132	270	8 May–22 July
0	0	0	1	1	0	0	2	1	2	3	24 July–5 Aug.
0	0	0	0	2	0	0	0	2	0	2	15 May–22 May
1	0	1	1	1	4	1	0	5	1	6	22 May–17 June
0	0	0	1	0	0	1	0	0	1	1	7 Aug.–7 Aug.
0	0	0	0	0	1	0	0	1	0	1	3 June–3 June
0	1	2	1	1	2	0	2	3	2	5	14 Aug.–12 Aug.
0	0	0	1	1	0	6	0	1	6	7	29 May–3 July
0	0	0	0	0	0	0	0	0	0	0	
2	0	0	0	3	1	0	0	4	0	4	8 May–5 Aug.
2	2	0	2	3	0	3	2	3	5	8	22 May–10 June
1,077	646	383	238	2,775	283	1,339	376	3,058	1,715	4,773	8 May–22 July
2	2	2	0	6	1	4	1	7	5	12	15 May–1 July
0	0	0	0	1	0	0	0	1	0	1	5 June–5 June

Table 1. Continued.

Family Species	Maple		Hickory		Red Oak	
	G	M	G	M	G	M
Zanclognatha lituralis (Hübner)	0	0	0	0	0	0
Zanclognatha laevigata (Grote)	0	0	0	0	1	0
Zanclognatha jacchusalis (Walker)	0	0	0	0	1	2
Renia sobrialis (Walker)	0	0	0	0	0	2
Bomolocha baltimoralis (Guenée)	1	0	0	0	0	0
Phoberia atomaris Hübner	1	0	2	1	47	8
Zale lunata (Drury)	0	0	0	0	0	0
Zale undularis (Drury)	0	1	0	0	0	0
Zale minerea (Guenée)	0	1	0	0	1	0
Parallelia bistriaris Hübner	2	0	0	0	0	0
Catocala epione (Drury)	0	0	19	1	0	0
Catocala flebilis Grote	0	0	3	2	0	0
Catocala ilia (Cramer)	0	0	0	0	15	3
Catocala similis W. H. Edwards	0	0	0	0	5	0
Catocala micronympha Guenée	0	0	1	0	1	0
Catocala amica (Hübner)	3	1	4	0	26	0
Meganola spodia Franclemont	0	0	0	0	1	0
Nola triquetrana (Fitch)	0	0	0	0	0	0
Acronicta lobeliae Guenée	0	0	0	0	0	1
Acronicta ovata Grote	0	0	0	0	0	1
Acronicta modica Walker	1	0	5	0	12	0
Acronicta haesitata (Grote)	0	0	0	0	0	0
Acronicta afflicta Grote	0	0	0	0	1	0
Lithophane innominata (J.B. Smith)	4	0	0	0	1	2
Lithophane querquera Grote	0	0	1	0	0	0
Lithophane antennata (Walker)	0	0	0	0	1	0
Epiglaea decliva (Grote)	1	0	5	0	16	0
Sunira bicolorago (Guenée)	0	0	0	0	0	1
Psaphida resumens Walker	1	0	0	0	0	0
Polia nimbosa (Guenée)	0	1	0	0	0	3
Morrisonia latex (Guenée)	13	4	21	8	92	19
Orthosia rubescens (Walker)	6	0	12	1	22	11
Orthosia hibisci (Guenée)	0	0	1	0	0	1
Himella intractata (Morrison)	0	0	0	0	0	1
Achatia distincta Hübner	0	0	1	0	0	0
Spaelotis clandestina (Harris)	1	1	0	0	0	0
Abagrotis alternata (Grote)	1	1	4	1	35	16
Acronicta sp.	0	0	0	0	0	0
Totals by tree species/forest/years	183	107	378	106	1,578	860
Grand Total by Tree Species	290		484		2,438	

bands lend themselves to diversity assessment by canvas bands. In our study, these species included in order of declining abundance, *Lymantria dispar, Morrisonia latex, Hypoprepia fucosa, Phoberia atomaris, Abagrotis alternata, Catocala amica, C. ilia, Orthosia rubescens,* and *Acronicta modica.*

Several of the more abundant species under bands in our study were among the more numerous band species in previous reports. In 1990 and 1991, Butler and Kondo (1993) noted that the five more abundant band larvae at Coopers Rock (WV) were *Lymantria dispar, Abagrotis alternata, Morrisonia latex, Orthosia hibisci* (Guenée), and *Halysidota tesselaris* (J. E. Smith). *Hypoprepia fucosa* and *Phoberia*

Table 1. Continued. Extended.

Chestnut Oak		White Oak		G		M		Years Combined		Grand Total	Seasonal Range
G	M	G	M	1995	1996	1995	1996	G	M		
0	0	0	1	0	0	0	1	0	1	1	13 May–13 May
0	0	1	3	1	1	3	0	2	3	5	8 May–6 May
0	0	0	0	0	1	0	2	1	2	3	3 June–17 June
0	0	0	0	0	0	0	2	0	2	2	10 June–17 June
0	2	0	1	0	1	3	0	1	3	4	7 Aug.–15 July
53	9	8	6	48	63	12	12	111	24	135	15 May–17 June
0	1	0	0	0	0	1	0	0	1	1	13 July–1 July
0	0	0	0	0	0	1	0	0	1	1	24 July–24 July
1	0	1	0	2	1	0	1	3	1	4	12 June–15 July
0	0	0	0	1	1	0	0	2	0	2	10 July–15 July
0	0	0	0	14	5	1	0	19	1	20	15 May–3 June
0	0	0	0	3	0	2	0	3	2	5	5 June–19 June
13	11	2	11	27	3	16	9	30	25	55	8 May–3 June
0	0	0	0	3	2	0	0	5	0	5	15 May–20 May
8	1	2	0	9	3	0	1	12	1	13	22 May–1 July
18	21	6	0	49	8	20	2	57	22	79	22 May–12 Aug.
0	0	0	0	0	1	0	0	1	0	1	6 May–6 May
0	0	0	1	0	0	1	0	0	1	1	12 June–12 June
0	0	0	0	0	0	1	0	0	1	1	24 July–24 July
2	1	0	1	2	0	1	2	2	3	5	5 June–12 Aug.
11	3	3	16	27	5	7	12	32	19	51	17 July–12 Aug.
0	0	0	1	0	0	1	0	0	1	1	14 Aug.–14 Aug.
0	0	0	0	0	1	0	0	1	0	1	15 July–15 July
0	2	0	1	5	0	5	0	5	5	10	29 May–3 July
0	0	0	0	1	0	0	0	1	0	1	29 May–29 May
0	0	0	0	0	1	0	0	1	0	1	24 June–24 June
14	0	4	1	33	7	1	0	40	1	41	8 May–27 May
0	0	0	0	0	0	1	0	0	1	1	29 May–29 May
0	0	0	0	1	0	0	0	1	0	1	15 May–15 May
0	1	0	0	0	0	2	3	0	5	5	8 May–27 May
96	16	28	18	68	182	26	39	250	65	315	10 July–12 Aug.
15	2	1	1	46	10	11	4	56	15	71	22 May–17 June
1	0	0	0	2	0	0	1	2	1	3	22 May–6 May
0	0	0	0	0	0	0	1	0	1	1	10 June–10 June
0	0	0	0	1	0	0	0	1	0	1	10 July–10 July
0	1	0	0	1	0	2	0	1	2	3	5 June–19 June
32	13	7	7	51	28	32	6	79	38	117	8 May–27 May
1	0	0	0	0	1	0	0	1	0	1	22 July–22 July
1455	795	504	381	3,400	698	1,729	520	4,098	2,249	6,347	
2,250		885									

atomaris were not among the 40 species of band larvae reported for that study. In a 6-year study in the Fernow Experimental Forest, WV, the 5 more abundant species under burlap tree bands were *Lymantria dispar, Morrisonia latex, Orthosia rubescens, Abagrotis alternata,* and *Lithophane hemina* Grote (Butler et al. 1995a). In 1992, Wagner et al. (1995) found the 5 more abundant macrolepidoptera at Goshen (Rockbridge Co., VA) to be *Phoberia atomaris, Hemileuca maia, Dasychira basiflava* (Packard), *D. obliquata* (Grote and Robinson), and *Hypoprepia fucosa.*

In three studies in which macrolepidopteran larvae were collected from both tree foliage and tree bands, more species of larvae were always taken from foliage. How-

Table 2. Temperature and rainfall measurements from May through August, 1995 and 1996 for the George Washington National Forest (GWNF) and Monongahela National Forest (MNF).

		Temperature (°C)		
Year	Forest	Average Low	Average High	Rainfall (cm)
1995	GWNF	16.8	28.5	21.8
	MNF	13.9	23.8	16.8
1996	GWNF	12.0	27.1	39.1
	MNF	10.0	24.4	49.3

ever, in all three of these studies, several species were taken only from beneath canvas bands: Butler and Kondo (1993) recorded 10 species and Butler et al. (1995) recorded 21 species only under bands; Wagner et al. (1995) noted 19 species under bands but not on foliage. We do not consider any of the species we collected in this study to be rare within our study plots. Many of the larvae poorly represented under bands were relatively abundant as sampled by other methods (unpublished data).

Previous studies have used canvas or burlap bands to evaluate the impact of forest insecticides including diflubenzuron (Butler and Kondo 1993, Butler et al. 1997) and *Bacillus thuringiensis* on nontarget insects (Wagner et al. 1996), and to study Lepidoptera diversity (Butler et al. 1995a, b; Wagner et al. 1995). From results of our studies, we recommend that tree bands are useful also for evaluating seasonal differences, including weather effects, and impact of *Entomophaga maimaiga* on populations of the gypsy moth. In future publications from this study, we will evaluate impact of *Bacillus thuringiensis* application to Lepidoptera as sampled by canvas bands, foliage pruning, and blacklight traps.

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